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A METHOD FOR APPLYING AND REMOVING BIRD-EXCLUSION NETTING IN COMMERCIAL VINEYARDS

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Grape growing and wine making are rapidly expanding industries on eastern Long Island, New York. In Suffolk County, land under wine-grape cultivation has increased >10 times between 1980 and 1987, from 43–504 ha (U.S. Dep. of Commer. 1987:355). Twenty-five of 35 Long Island growers who responded to a 1986 survey rated bird depredations as their biggest problem (L. D. Fuller-Perrine, unpubl. data, 1986). American robins (*Turdus migratorius*), house finches (*Carpodacus mexicanus*), European starlings (*Sturnus vulgaris*), and common grackles (*Quiscalus quiscula*) are the major pest species (L. D. Fuller-Perrine, unpubl. data, 1986–1987).

Few control measures are available for reducing bird damage in vineyards. Techniques of population reduction such as trapping, shooting, and poisoning either are legally restricted, are not cost-effective, or do not result in reduced damage (Dolbeer 1986). Scare devices such as propane exploders, electronic noisemakers, hawk-kite models, and reflective tape may deter avian pests for short periods, but birds generally habituate to them (Conover 1979, Spanier 1980, Hothem and DeHaven 1982, Summers 1985, Tobin et al. 1988). Mesurol® (reference to commercial products is for identification purposes only and does not indicate endorsement by the authors, Cornell Univ., or the U.S. Dep. of Agric.) is a chemical repellent that has been used effectively to reduce bird feeding on grapes (Bailey and Smith 1979, Hothem et al. 1981, Tobin and DeHaven 1984), but no longer is available for use in vineyards in the United States (Tobin and Dolbeer 1987). Bird-exclusion netting also is effective (Stucky 1973, Foster 1979), but the high cost of materials and perceived difficulty of applying and removing the netting has discouraged most growers from using this alternative.

The expectation of extensive damage to a high-value crop may warrant the implementation of costly protection measures (Bruggers and Ruelle 1982). Most of the grapes planted on eastern Long Island, such as Chardonnay, White Riesling, and Cabernet Sauvignon, have high economic value and even moderate levels of bird damage may result in unacceptable economic losses. This, and the lack of other effective controls, may justify the use of protective netting in susceptible vineyards.

During 1987, we evaluated the costs associated with installing and removing nets with tractor-mounted mechanical units. Below we describe the units and report on their cost-effectiveness. In 1986 and 1987, we evaluated levels of bird damage in portions of 3 vineyards.

MATERIALS AND METHODS

Bird-exclusion Netting

Two tractor-mounted units were designed to apply 5.2-m-wide nets directly over vines. One unit, built by a private grower, was mounted on the front of the tractor's bucket loader (Fig. 1). The other unit, built by Cornell University, was mounted on the rear of the tractor with a 3-point hitch. Both units were powered by the tractor's standard hydraulic system. Each unit

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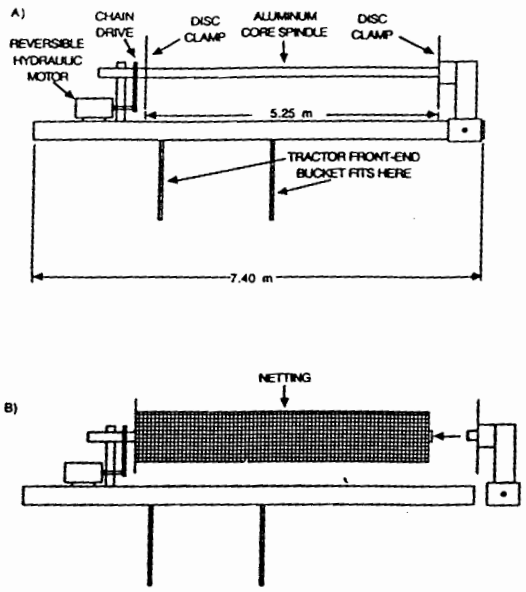

Fig. 1. (A) Diagram of over-the-row bird netting applicator suitable for mounting on tractor front-end bucket-loader. (B) Diagram of over-the-row bird netting applicator suitable for mounting on tractor front-end bucket-loader with netting in place.

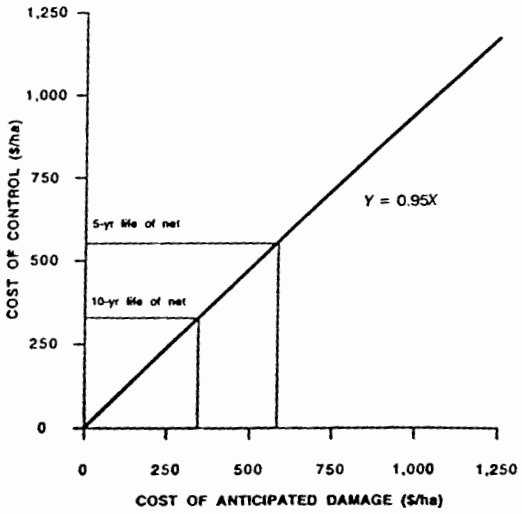

Fig. 2. Cost-benefit equation (Dolbeer 1981) for netting based on estimated 95% reduction in bird damage by netting. Using estimated cost of application, estimated levels of damage reduction, and price/kg of grapes, the break-even point for using bird netting can be determined. Yields were assumed to be 6,804 kg/ha and grape prices $1.32/kg.

consisted of a frame, a spool, and a hydraulic motor. The frames were 6.1 m wide and built of 8.9-cm square-stock steel (0.8 cm thick) that was sturdy enough to remain rigid while holding a 136-kg roll of netting 3 m above the ground as the tractor moved at 4.0 km/hour. The spool that held the roll of netting consisted of 2 metal discs, 61 cm in diameter between which the roll was held, and a detachable aluminum spindle (8.9 cm diam) that supported the roll and was secured to each of the discs. The entire netting application unit was secured to the front-end bucket loader of the tractor, enabling the spool and netting roll to be elevated above the row of vines to the right side of the tractor. The hydraulic motor on each unit was reversible so that netting could be applied or removed by reversing oil flow with a control valve. Each unit could be lowered to the ground for loading and unloading netting. Black plastic netting (1.90- × 1.75-cm mesh; Conwed Plastics, 760 29th Ave. S.E., Minneapolis, MN 55414) was used on all vineyards in this study.

In August of 1987, netting was draped over the vines at 4 sites: 2 0.4-ha blocks (1 each of White Riesling and Cabernet Sauvignon, 20 rows of 152 m each) at Mattituck Hills Vineyard in Mattituck; a 2.0-ha block (31 rows of 244 m each) of Pinot Noir at Bidwell Vineyards in Cutchogue; and a 2.0-ha block (36 rows of 213 m each) of Pinot Noir at Pindar Vineyards in Peconic. The trellising at Mattituck Hills was a low-wire, cordon, spur-pruned system. The vines at Bidwell and Pindar were trained to a top-wire, cordon, spur-pruned system.

Applications and removals were timed on a per-hectare basis at all sites. The nets were applied at veraison (when grapes change color and begin to accumulate sugar), between 15 and 25 August. Three people applied the netting at each site. To load the netting, the applicator unit was lowered to the ground where 2 people could lift a roll of netting onto it. One person then drove the tractor with the applicator unit up and down the rows of vines at 3.6–4.0 km/hour while 2 people followed behind and, where necessary, pulled the netting over the vine so that it touched the ground. At the end of each row, the tractor stopped to allow the netting to be cut. At both ends of each row, the netting was secured to the ground at the trellis end-post anchor with plastic-coated bread ties. One to 2 days before harvest at each vineyard (mid-September to mid-October, depending on the site), 3 people used the reverse process to remove the netting from the vines and roll it back onto an empty core. During removal, 1 person drove the tractor up and down the rows at 3.2–4.0 km/hour while 2 people lifted the net off the vines and stretched it from side to side to facilitate re-rolling it onto the core. We recorded the time required to install and remove the netting.

Damage Appraisal

We assessed bird damage during 1986 and 1987 in portions of 4 commercial vineyards on the North Fork of Long Island, New York. The vineyards and sites were not selected at random and may not be repre-

sentative of the entire vineyard at each site or of other vineyards in the area. The damage figures were used only as examples for evaluating the cost-effectiveness of the netting technique. All assessments were of Chardonnay grapes. The block at San Andres Vineyard was 3.2 ha and contained 45 rows of about 457 m in length. The Mattituck Hills Vineyard study site was 4.9 ha and contained 80 rows of about 220 m in length. The study block at Gristina Vineyards comprised 2.8 ha consisting of 21 rows of 244 m each. The study block at Massoud Vineyards contained 5.7 ha consisting of 50 rows of about 412 m each.

Bird damage was evaluated at each site <48 hours before harvest using the method reported in DeHaven and Hothem (1979). A pretransformed, arcsine rating scale of 0–8 (Little and Hills 1978:163) was used to estimate damage on 5 clusters randomly selected from each of 40 randomly selected vines at each site. We assumed that all missing and pecked grapes were caused by foraging birds.

RESULTS

Bird-exclusion Netting

Application of the netting, including loading and unloading rolls, averaged 2.5 hours/ha, using 3 people (7.5 person-hr/ha), in each of the 4 blocks. Removal of the netting required 7.5 person-hours/ha at Bidwell and Pindar Vineyards and at the White Riesling block of Mattituck Hills Vineyard. Removal of the netting took 11.1 person-hours/ha for the Cabernet Sauvignon block at Mattituck Hills Vineyard. Thus, labor averaged 15.9 hours/ha (range 15.0–18.6 person-hr/ha) to apply and remove the netting at the 4 sites. At $7/hour, total labor costs averaged $111 (range $105–130/ha/yr), or 21–24% of the total cost of materials, construction, and labor for the netting program.

The most expensive item, netting, accounted for approximately 70–74% of the total cost of the program. The price of a 1,524-m roll of netting (5.2 m wide), which covered 0.4 ha of vines, was $750. Prorated over 5 years (the manufacturer's estimate of the minimum useful life of the net), the cost of the netting would be $375/ha/year. The hydraulically powered netting application-removal units cost $3,500 each, including $2,000 for materials and $1,500 for construction labor. Assuming a 12-ha vineyard and a 10-year useful life for the unit, the cost for materials and labor to build the unit would amount to $29/ha/year, or about 5–6% of the total cost. Thus, the average total cost of procurement, construction, and labor for employing this netting system for a 12-ha vineyard, prorated over 10 years, would be $515/ha/yr (range $509–534/ha/yr).

We did not conduct damage assessments in the netted vineyards, but we inspected bunches as we removed the netting and harvested the grapes. With the exception of 5–10 bunches of grapes at each site that were damaged by birds that entered under the net, we saw no bird damage at any of the 4 sites where netting was used. Thus, we believe that the nets essentially eliminated bird depredations of grapes.

At each site, 20–50 birds entered under the netting after application and became trapped. One or 2 birds/site became entangled in the netting and died; we released the rest.

Damage Appraisal

In 1986, the percentage of grapes pecked or removed by birds averaged 9.7% (range = 1.7–27.7%) for the 4 vineyards. In 1987, bird damage averaged 10.1% (range = 2.3–18.6%). Yields averaged 8,699 kg/ha (range = 6,735–12,010 kg/ha) in 1986. Yields averaged 5,865 kg/ha (range = 3,592–8,082 kg/ha) in 1987. Based on an average grape value of $1.32/kg, bird damage in the 4 blocks resulted in average annual losses of $1,213/ha (range = $151–3,407/ha) in 1986, and $653/ha (range = $296–1,091/ha) in 1987.

DISCUSSION

For vineyards with grapes that have high economic value and historically sustain high levels of bird damage, the netting system evaluated in this study would be cost-effective for reducing depredations. Because the cost of constructing the application-removal unit could be prorated over larger areas, large vineyards would find it more economical to use bird-protective netting. The total cost of purchas-

ing, applying, and removing the netting, based on an estimated net life of 5 years, was $509–534/ha/year. Assuming that the netting was 95% effective in preventing bird depredations, 2 of the 4 blocks where we evaluated damage during 1986 and 1987 would have benefited during both years from using this netting system (Fig. 2). Using an analysis similar to that proposed by Dolbeer (1981), San Andres Vineyard, the site with the most damage, would have a cost:benefit ratio of 1:7 in 1986. With yields and market conditions encountered in this study, expected damage levels would have to be at least 6.2% for yields of 6,804 kg/ha (Fig. 2). If the netting lasts 10 years (as the manufacturer claims), a grower would have to sustain $317–341/ha/year or about 3.6% damage to justify using the netting.

The biggest problems with the netting program occurred with a vigorous variety (Cabernet Sauvignon) on a vigorous soil (Mattituck Hills) where vines continued to grow after the onset of ripening. This continuous vegetative growth resulted in vine shoots growing through the net, which hampered net removal and sometimes caused net tearing. The same variety of grape on a less vigorous soil did not continue to grow after veraison, and thus the vines did not become entangled in the net. Because rich soils, vigorous varieties, and excess rainfall all promote late-season vine growth, growers using netting on vigorous varieties or rich soils might find it more difficult and costly to use bird-protection netting. At low-to-moderate vigor sites where vines stop growing at or before veraison, vines are not likely to become entangled with nets applied after veraison.

In the 4 years since this study, 8 additional growers on Long Island have used tractor-mounted units to apply and remove bird netting in their vineyards. During the 1991 season, 12 of the 35 Long Island growers, including several growers who netted their entire vineyards, used netting on 113 ha of vineyard.

The cost-effectiveness of bird-protection netting is dependent on the longevity of the netting. As of 1991, the same nets have been used for 5 consecutive years at the 4 sites, and <1% of the length of the nets has been torn during application and removal. The vineyardists involved expect these nets to last ≥2 more years. Photodegradation of the plastic nets is minimized by storing the nets under cover for the 46 weeks each year they are not in use.

Bird mortality is a potential hazard of using bird-protection netting. High bird mortality has been reported with flexible netting (Twedt 1980), but the netting used in this study was made of stiffer plastic that is less prone to entangle birds. The dead birds we found entered under the nets where the netting did not reach the ground. More careful application to ensure that there are no gaps between the bottom of the netting and the ground should reduce the number of birds able to enter.

SUMMARY

Two types of tractor-mounted, hydraulically powered units were developed for applying and removing bird-exclusion netting from grape vines. The netting system provided cost-effective protection where high levels of damage (>6% on 6,804 kg/ha yields) were anticipated, but may not be practical in small vineyards or where low levels of damage are expected. Controlled experiments are needed to quantify the effectiveness of this netting system. Vegetative growth after the onset of grape ripening and the resulting entanglement of vine shoots in the netting may preclude cost-effective use of bird-protective netting with vigorous varieties (e.g., Cabernet Sauvignon) growing on rich soils. Entanglement of birds in nets is a potential source of mortality.

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